



BOOK REVIEW

## Mauricio Suárez, *Inference and Representation: A Study in Modeling Science*

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Understanding scientific practice requires understanding the use of models as tools to represent objects of inquiry. This book is a captivating testament to over two decades of research on scientific models. It presents a compelling, well-argued and provocative defence of Suárez's inferentialist account of representation. Its main theoretical claims on inferentialism (Part 2) and argumentative structure mirror those of Suárez's seminal paper, 'An inferential conception of scientific representation' (*Philosophy of Science* (2004) 71); however the book has two further aims: tracing a historical thread that links the emergence of the modelling attitude in the late nineteenth century to the evolution of Suárez's inferentialism (Part 1), and extending the application of the inferential account of representation to the realms of art and scientific epistemology (Part 3). Inferentialism – the book's main takeaway – is an account of representation that is minimal, widely applicable and compatible with scientific practice and its use of models.

Much recent debate in philosophy of science has centred on models and representation. According to what Suárez calls the 'official story' (p. 2), a general shift to a semantic view of scientific theories, and its focus on Tarskian models, reignited the philosophical interest in models in science in the second half of the twentieth century. However, in the introductory Chapter 1, Suárez situates his work within a different narrative, rooted in pragmatic efforts to understand scientific practice. By discussing the works of James Clerk Maxwell, William Thomson, Heinrich Hertz and Ludwig Boltzmann, Chapter 2 makes a case for considering the core features of the modelling attitude of nineteenth-century physics as historical antecedents of the minimal conditions for representation in Suárez's inferential account. While the range of literature surveyed is impressive, this breadth occasionally comes at the cost of the survey's depth. For instance, Alisa Bokulich's analysis (*Studies in History and Philosophy of Science* (2015) 50) reveals that Maxwell might have held a more structuralist view of representation than Suárez's reading suggests. To complement this historical analysis, in Chapter 3 Suárez presents an inductive argument using a variety of case studies to show that 'all models function representationally' in a minimal sense (p. 45). For example, the discussion of the 1890 model of the Forth Rail Bridge (featured on the book's cover) illustrates that one need only grasp the intended use of a model as a tool for informative inferences to understand its representational function.

Chapter 4 begins the second part. Suárez distinguishes between substantive and deflationary accounts of representation. The former are reductionist: they reduce representation to some other *constitutive* relation between model and target. The latter

are primitivist: they hold that the representational relation between model and target is primitive and unanalysable, and instead focus on the *means* or context-dependent properties of a particular representation. While similarity and isomorphism – traditional candidates for a substantive approach – might serve as the means of a representation, they fail as constituents of such a relation, as convincingly argued in Chapter 5. In Chapter 6, Suárez demonstrates the compatibility of his deflationary account with popular views of scientific theories, particularly semantic views. Finally, in Chapter 7, Suárez presents his minimal and primitive account of representation in full, which consists of two necessary conditions: *representational force* and *inferential capacity*. The former is a representation's 'capacity to lead a competent and informed user to its representational target' (p. 160); the latter states that the source, or model, must have the capacity to license inferences regarding the target (p. 157). According to the two criteria, nothing represents unless someone uses it as a representation in specific contexts to draw some inferences regarding a target. Representations are thus contextual – they obtain by virtue of socially enforced conventions. However, Suárez's analysis might have benefited from a deeper engagement with his examples of representational practices to show how conventions about representational force are established. On the contrary, his use of case studies is limited, tending to confirm his claims *post hoc* rather than constituting the grounds on which they are built. While his analysis provides useful insights into modelling practices, historians of science might further detail how representational force is socially sanctioned: as contexts of inquiry change, so do the competencies and purposes of the communities of inquirers who license representational forces.

In Part 3, Suárez shows the wide range of applicability of his inferential account. For instance, a compelling feature of his inferentialism is its ability to explain the representational character of works of art, regardless of their degree of resemblance towards their subject (Chapter 8). Additionally, Suárez claims that the inferential conception helps to clarify debates about experimental realism and the difference between scientific explanation and scientific understanding (Chapter 9).

Suárez's book provides one of the most original and compelling accounts of representation to emerge thus far in the twenty-first century. His ambitious account is amenable to wide-ranging cases of cognitive representation and its minimal requirements ensure that it captures diverse cases of modelling practice across disciplines. Thus the inferentialist account might be attractive to those who take seriously a practice-oriented approach to understanding scientific knowledge and who are less interested in the metaphysics of representation. However, the wide applicability of Suárez's proposal and its primitivism about representation come at the cost of explanatory power. Gabriele Contessa (*Philosophy of Science* (2007) 74) argues that it leaves us with a 'mysterious' notion of scientific representation. Similarly, Roman Frigg and James Nguyen remark that adopting such an inferentialist account 'seems to amount to abandoning the philosophical project of understanding how scientific representation works' (*Scientific Representation* (2022), p. 41). Given the purpose and length of the book, it would have been helpful if Suárez had included responses to past critiques of his account, many of which come from sympathetic perspectives. Suárez motivates his inferential conception by adopting a 'negative' argumentative strategy: when all other substantive accounts fail, a deflationary stance is the only one that can make sense of scientific modelling practice. This book, as any insightful philosophical work does, therefore prompts a fundamental question concerning the scope of philosophy of science: should we aim at the best descriptive account of scientific practice, or should we strive to articulate some further normative claims?